

STATEMENT

I, Shinya KATO of NGB Corporation, Toranomon East Building, 7-13, Nishi-shimbashi 1-chome, Minato-ku, Tokyo 105-8408, Japan, hereby state that I am conversant with both English and Japanese languages and certify to the best of my knowledge and belief that the attached is a true and correct English translation of the Faithful Translation of Japanese Priority Document 2001-038070.

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[Article]	Specification	1 copy
[Article]	Drawings	1 copy
[Article]	Abstract	1 copy
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[Document Name] Specification

[Title of the Invention] Printing System

[What is claimed is]

[Claim 1] A printing system including a printing means

5 and a controlling means for controlling the printing means,
and having a power saving mode for stopping a supply of a
power source to at least the controlling means,

the printing system comprising:

a deciding means for deciding a shift from a normal
10 mode to the power saving mode;

a setting means for setting communication control
information used in the shift from the power saving mode
to the normal mode after the shift to the power saving mode
is decided by the deciding means; and

15 a receiving means for receiving data based on the
communication control information set by the setting means
in the shift from the power saving mode to the normal mode
not to use the controlling means.

[Claim 2] A printing system according to claim 1,

20 wherein the printing system set forth in claim 1 is connected
to an upper system via a serial bus, and

the receiving means decides whether or not information
is directed to own system, by referring an address area in
a packet and then responds to only the information addressed
25 to own system when the information is transmitted from the

upper system via serial communication.

[Claim 3] A printing system according to claim 1, wherein the printing system set forth in claim 1 is connected to an upper system via a parallel bus, and

5 the deciding means decides a mode shift by detecting change of an input control signal of a parallel interface.

[Claim 4] A printing system including a printing means and a controlling means for controlling the printing means, and having a power saving mode for stopping a supply of a 10 power source to at least the controlling means,

the printing system comprising:

storing means for storing received data;

deciding means for deciding a receiving speed based on a returning time from the power saving mode to a normal 15 mode and a capacity of the storing means; and

receiving means for receiving data based on the receiving speed decided by the deciding means in a shift from the power saving mode to the normal mode to store the data in the storing means.

20 [Claim 5] A printing system according to claim 4, wherein the deciding means decides dynamically the receiving speed in view of a residual capacity of the storing means.

[Claim 6] A printing system according to claim 4, 25 wherein the printing system set forth in claim 4 is connected

to an upper system via a serial bus, and

the deciding means decides the receiving speed based on setting of a data payload in a packet in receiving serial data from the upper system.

5 [Claim 7] A printing system according to claim 4, wherein the printing system set forth in claim 4 is connected to an upper system via a serial bus, and

the deciding means decides the receiving speed based on a rate of notices informing that reception can be normally 10 completed and notices informing that the reception cannot be normally completed, in replying a receiving response to the upper system.

[Claim 8] A printing system according to claim 4, wherein the printing system set forth in claim 4 is connected 15 to an upper system via a parallel bus, and

the deciding means decides a mode shift by detecting a change of an input control signal in a parallel interface.

[Detailed Description of the Invention]

20 [0001]

[Technical Field of the Invention]

The present invention relates to a printing system for receiving print data transmitted from an upper system to execute a printing process and, more particularly, a 25 printing system having a power-saving mode that can save

the power (energy) by stopping the power source and the clock supplied to a printing portion, a controlling portion, etc. in the standby state in which no printing process is executed.

5 [0002]

[Prior Art]

In the prior art, as the system of this type, it has been well known the system employing the system that the power supply of the system is turned ON while asserting the 10 first output control signal (busy signal) when the receiving operation is started in the power-saving mode, and then the busy signal is negated when the initialization is completed (see Patent Application Publication (KOKAI) Hei 10-56526, for example). In other words, the receiving operation from 15 the parallel interface is stopped once by asserting the busy signal, and then the receiving operation is started again by negating the busy signal at the stage when the receiving preparation is completed by turning ON the power supply of the system.

20 [0003]

[Subjects to be Solved by the Invention]

However, in the above prior art, first the CPU of the controlling portion for controlling the overall system executes the building-up process at the time of returning 25 from the power-saving mode, and then the operation is shifted

to the receiving operation. For this reason, it may be considered such a situation that, if a time required for a building-up process of CPU is long, a return time from the power-saving mode to the normal mode (normal transfer 5 mode) exceeds a time-out time of the data transmission on the upper system side, e.g., the host computer side, to thus cause the transmission error.

[0004]

At that time, since the process to transmit the data 10 once again, to interrupt temporarily the transmission, or the like is carried out on the host computer side, there is the problem that the data transfer efficiency is extremely lowered. Also, according to this, there is the possibility that a time required to start the printing when the receiving 15 operation is started in the power-saving mode, i.e., FPOT (First Print Out Time) is increased extremely.

[0005]

The present invention has been made in view of the above subjects, and it is an object of the present invention to 20 provide a printing system capable of avoiding the generation of the time-out error on the upper system side and also enabling the optimization of FPOT, in shifting the mode from the power-saving mode to the normal mode even when a time required for a building-up process of CPU is long.

25 [0006]

[Means for Solving the Subjects]

A printing system of the present invention including a printing means and a controlling means for controlling the printing means, and having a power saving mode for 5 stopping a supply of a power source to at least the controlling means, the printing system comprising a deciding means for deciding a shift from a normal mode to the power saving mode, a setting means for setting communication control information used in the shift from 10 the power saving mode to the normal mode after the shift to the power saving mode is decided by the deciding means, and a receiving means for receiving data based on the communication control information set by the setting means in the shift from the power saving mode to the normal mode 15 not to use the controlling means.

[0007]

In the printing system having the above configuration, when the shift from the normal mode to the power saving mode is decided by the deciding means, the setting means sets 20 the communication control information used in the shift from the power saving mode to the normal mode in response to this. Then, the receiving means can receive the data based on the communication control information previously set by the setting means without the intervention of the controlling 25 means in the shift from the power saving mode to the normal

mode.

[0008]

A printing system of the present invention including a printing means and a controlling means for controlling the printing means, and having a power saving mode for stopping a supply of a power source to at least the controlling means, the printing system comprising a storing means for storing received data, a deciding means for deciding a receiving speed based on a returning time from the power saving mode to a normal mode and a capacity of the storing means, and a receiving means for receiving data based on the receiving speed decided by the deciding means in a shift from the power saving mode to the normal mode to store the data in the storing means.

15 [0009]

In the printing system having the above configuration, first the deciding means decides the receiving speed of the data based on the returning time from the power saving mode and the capacity of the storing means. Then, in the shift 20 from the power saving mode to the normal mode, the receiving means receives the data based on the receiving speed previously decided by the deciding means and then stores the received data in the storing means.

[0010]

25 [Embodiments of the Invention]

Embodiments of the present invention will be explained in detail with reference to the drawings hereinafter.

[0011]

[First Embodiment]

5 FIG.1 is a block diagram showing an outline of a configuration of a printing system according to a first embodiment of the present invention. In FIG.1, a printing system 10 of the present embodiment is constructed such that such printing system comprises a printing portion 11, a print 10 controlling portion 12 for controlling the printing portion 11, and a main power supply portion 13, and is connected to a host computer 20 as an upper system, for example, via a serial bus 30 to transmit/receive the serial data to/from the host computer 20.

15 [0012]

The print controlling portion 12 is constructed such that such print controlling portion has a communication I/F (interface) 14 for executing the communication with the host computer 20 via a serial bus 30, and a controlling portion 20 15 for controlling the overall present system, and the power source is directly supplied from the main power supply portion 13 to the communication I/F (interface) 14, and also the power source is selectively supplied to the printing portion 11 and the controlling portion 15 via a power supply 25 switch 16.

[0013]

In this print controlling portion 12, the communication I/F 14 has a configuration that has a serial/parallel I/F 141, a command/data analyzing portion 142, a data payload controlling portion 143, a power-saving controlling portion 144, a buffer storing portion 145, a data-storing controlling portion 146, and a response controlling portion 147. In this communication I/F 14, the serial/parallel I/F 141 executes an action to convert the serial data received from the host computer 20 into the parallel data and also convert the parallel data processed in own device into the serial data.

[0014]

The command/data analyzing portion 142 analyzes the command in the data received from the host computer 20 and the data contents. As an example, this command/data analyzing portion 142 executes the decision whether or not the data is directed to own device, by looking up the address area in the packet. Where the packet signifies the unit in which the information are arranged to have a predetermined size. Then, the data block to be transmitted, i.e., the frame is constructed by sets of the packets (packet group).

[0015]

The data payload controlling portion 143 controls the data payload from the host computer 20 per one packet. The

power-saving controlling portion 144 issues appropriately a power-saving mode shift authorization response signal for permitting the shift from the normal transfer mode (normal mode) to the power-saving mode, a power-saving mode cancel 5 informing signal, and an interrupt informing signal to the CPU 151.

[0016]

The data received from the host computer 20 are stored in the buffer storing portion 145 under the control of the 10 data-storing controlling portion 146. The communication control information indicating what response should be made to the data received from the host computer 20 in the shift from the power-saving mode to the normal transfer mode are set previously in the response controlling portion 147 under 15 the control of the CPU 151.

[0017]

Here, as the communication control information, for example, there may be listed the information as to a predictive time required until the process in the print 20 controlling portion 12 can be started after the CPU 151 returns from the power-saving mode to the normal transfer mode and completes the boot process, a storing amount (capacity) of the buffer storing portion 145, the maximum data payload form the host computer 20 per one packet, a 25 reply rates of the ACK response and the NAK response to the

data received from the host computer 20, etc. These communication control information may be set arbitrarily.

[0018]

The controlling portion 15 is constructed such that 5 such controlling portion has the CPU 151, a RAM 152, a ROM 153, a DMAC 154 for executing the DMAC (Direct Memory Access Controller) transfer, and a power supply controlling portion 155, and is connected mutually to the communication I/F 14 via the parallel bus 17. In this controlling portion 10 15, the DMAC 154 issues a DMA transfer authorization signal to the data-storing controlling portion 146 when the CPU 151 completes the boot process.

[0019]

The power supply controlling portion 155 is provided 15 to control ON(close)/OFF(open) of the power supply switch 16 that supplies/stops the power supply voltage to the printing portion 11 and the controlling portion 15. The power supply controlling portion 155 stops the power source 20 to the printing portion 11 and the controlling portion 15 by turning OFF the power supply switch 16 in response to this when the power-saving mode shift authorization response signal is issued from the power-saving controlling portion 144, and also supplies the power source to the printing portion 11 and the controlling portion 15 by turning 25 ON the power supply switch 16 in response to this when the

power-saving mode cancel informing signal issued from the power-saving controlling portion 144.

[0020]

Next, an operation of the printing system 10 having the above configuration according to the first embodiment will be explained in compliance with a flowchart in FIG.2 hereunder. Here, controlling procedures in the shift from the normal transfer mode to the power-saving mode and then to the normal transfer mode in response to the power-saving mode canceling information will be explained.

[0021]

In the state that the normal transfer mode is set (step S101), when the print controlling portion 12 is not receiving the data addressed to own system from the host computer 20, such print controlling portion 12 monitors the request for the shift to the power-saving mode issued from the CPU 151 (the issue of the power-saving mode shift authorizing response signal) (step S102). The CPU 151 sets previously the communication control information, that indicates what response should be made to the data received from the host computer 20 in the shift from the power-saving mode to the normal transfer mode, in the response controlling portion 147 (step S103).

[0022]

25 When the setting of the communication control

information to the response controlling portion 147 is completed under the control of the CPU 151 (step S104), the power-saving controlling portion 144 issues the power-saving mode shift authorization response signal to the power supply controlling portion 155 (step S105). When the power supply controlling portion 155 receives the power-saving mode shift authorization response signal, it stops the power source supply to the printing portion 11 and the controlling portion 15, i.e., the CPU 151, the RAM 152, the ROM 153, and the DMAC 154, by turning OFF the power supply switch 16. As a result, the operation mode is shifted to the power-saving mode.

[0023]

In the power-saving mode, the serial/parallel I/F 141 and the command/data analyzing portion 142 always monitor the contents of the data from the host computer 20, i.e., whether or not the data addressed to own system is detected (step S106). The data addressed to own system is decided by looking up the address area in the packet. If the serial/parallel I/F 141 and the command/data analyzing portion 142 receive the data addressed to own system from the host computer 20, the power-saving controlling portion 144 issues the power-saving mode cancel informing signal to the power supply controlling portion 155 and also issues the interrupt informing signal to the CPU 151 in response

to this (step S107).

[0024]

When the power supply controlling portion 155 receives the power-saving mode cancel informing signal, it starts 5 the power source supply to the printing portion 11 and the controlling portion 15 by turning ON the power supply switch 16. When the power supply is supplied to the CPU 151, first this CPU 151 executes the boot process. During the boot process of the CPU 151, the response controlling portion 10 147 executes the communication with the host computer 20 in accordance with the communication control information stored therein (step S108). Also, the response controlling portion 147 monitors the reception of the DMA transfer authorization signal from the DMAC 154 (step S109). In this 15 case, the details of the setting operation of the communication control information will be described later.

[0025]

When the CPU 151 finishes the boot process, the DMAC 154 issues the DMA transfer authorization signal to the 20 data-storing controlling portion 146 in response to this. When the data-storing controlling portion 146 receives the DMA transfer authorization signal from the DMAC 154, it starts the transmission of the DMA data onto the parallel bus 17 (step S110). Also, the CPU 151 issues the power- 25 saving mode cancel informing signal to the power-saving

controlling portion 144 and shifts to the normal transfer mode (step S111).

[0026]

Then, it will be explained hereunder at what mode the
5 communication control is executed between the host computer
20 as the upper system and the print controlling portion
12 based on the communication control information at the
time of return from the power-saving mode to the normal
transfer mode.

10 [0027]

FIG.3 shows an example of a relationship between a
communication time between the host computer 20 and the print
controlling portion 12 during the communication in
communication controlling modes based on the communication
15 control information, i.e., mode A, mode B, mode C, and mode
D, and an amount of data stored in the buffer storing portion
145, respectively.

[0028]

As described above, the communication control
20 information indicate a predictive time T0 required until
the process in the print controlling portion 12 can be
started after the CPU 151 returns from the power-saving mode
to the normal transfer mode and complete the boot process,
a storing amount of the buffer storing portion 145 (referred
25 simply to as a "buffer storing amount" hereinafter), the

maximum data payload form the host computer 20 per one packet, reply rates of the ACK response and the NAK response to the data received from the host computer 20, etc.

[0029]

5 In the mode A in FIG.3, when a time comes up to the predictive time T0 required until the process in the print controlling portion 12 can be started after the CPU 151 returns from the power-saving mode and completes the boot process, the buffer storing amount is small. The
10 communication control in this mode A can be implemented by setting low either the maximum data payload form the host computer 20 per one packet or the reply rates of the ACK response and the NAK response to the data received from the host computer 20, in order to lower the predictive time T0
15 required until the process in the print controlling portion 12 can be started after the CPU 151 returns from the power-saving mode and completes the boot process and the receiving speed.

[0030]

20 At this time, the maximum data payload and the reply rates of the ACK response and the NAK response to the received data may be lowered at the same time. The communication control in this mode A is suitable for the communication that has the relatively low emergency, like the cases where
25 the process in the print controlling portion 12 cannot be

started because other process is started after the CPU 151 returns from the power-saving mode and completes the boot process, etc.

[0031]

5 In the mode B in FIG.3, when the time reaches the predictive time T0 required until the process in the print controlling portion 12 can be started after the CPU 151 returns from the power-saving mode and completes the boot process, the buffer storing amount is large. The
10 communication control in this mode B can be implemented by setting high either the maximum data payload from the host computer 20 per one packet or the reply rates of the ACK response and the NAK response to the data received from the host computer 20, in order to increase the predictive time
15 T0 required until the process in the print controlling portion 12 can be started after the CPU 151 returns from the power-saving mode to complete the boot process, and the receiving speed.

[0032]

20 At this time, the maximum data payload and the reply rates of the ACK response and the NAK response to the received data may be set higher at the same time. The communication control in this mode B is suitable for the communication that has the relatively high emergency, like the cases where
25 the process in the print controlling portion 12 can be

started immediately because other process is not started after the CPU 151 returns from the power-saving mode and completes the boot process, etc.

[0033]

5 In the mode C in FIG.3, the predictive time T0 required until the process in the print controlling portion 12 can be started after the CPU 151 returns from the power-saving mode to complete the boot process, and a buffer storing amount set value Co are set. Then, such a communication 10 control is carried out that the print data is received normally before the buffer storing amount reaches the buffer storing amount set value Co while an amount of the received data is reduced into a predetermined level after the buffer storing amount has reached the buffer storing amount set 15 value Co.

[0034]

 In the mode D in FIG.3, the predictive time T0 required until the process in the print controlling portion 12 can be started after the CPU 151 returns from the power-saving mode to complete the boot process, and a buffer storing amount set value Co are also set. Then, such a communication 20 control is carried out that the print data is received normally before the buffer storing amount reaches the buffer storing amount set value Co while an amount of the received data is reduced gradually after the buffer storing amount 25

has reached the buffer storing amount set value Co.

[0035]

The communication control in the mode C and the mode D can be implemented by setting high either the maximum data payload from the host computer 20 per one packet or the reply rates of the ACK response and the NAK response to the data received from the host computer 20, in order to increase the buffer storing amount set value Co, that acts as a switching point to switch the predictive time T0 required until the process in the print controlling portion 12 can be started after the CPU 151 returns from the power-saving mode and completes the boot process and the receiving speed, and the receiving speed.

[0036]

At this time, the maximum data payload and the reply rates of the ACK response and the NAK response to the received data may be increased simultaneously. The communication control in the mode C and the mode D is suitable for the communication that has the relatively high emergency, like the cases where the ordinary data receiving speed is not reduced as much as possible and also the process in the print controlling portion 12 can be started immediately because other process is not started after the CPU 151 returns from the power-saving mode and completes the boot process, etc.

[0037]

As for the set values in the above communication control information, a predetermined value may be set every time when the CPU 151 shifts to the power-saving mode, otherwise a variable value may be set in response to the 5 history made prior to the shift to the power-saving mode, etc. when the CPU 151 shifts to the power-saving mode.

[0038]

In this case, although the explanation is omitted from the flowchart in FIG.2, it is needless to say that the print 10 controlling portion 12 of the printing system 10 operates while always monitoring the information of the suspend command and the resume command from the host computer 20.

[0039]

As described above, in the printing system 10 connected 15 to the host computer 20 as the upper system via the serial bus, the communication control information used in the shift from the power-saving mode to the normal transfer mode are set previously in the response controlling portion 147 before the CPU 151 in the print controlling portion 12 shifts 20 to the power-saving mode, and then the response controlling portion 147 executes the data transmission/reception based on the set communication control information in the cancel of the power-saving mode. As a result, after the cancel of the power-saving mode, the normal communication with the 25 host computer 20 can be carried out continuously without

the intervention of the CPU 151. In other words, the CPU 151 executes preferentially the boot process immediately after the cancel of the power-saving mode, but the communication with the upper system can be carried out during 5 this processing period.

[0040]

Also, if the information are transmitted from the host computer 20 to the printing system 10, it is decided whether or not the information is addressed to own system by 10 referring to the address area in the packet, and then the CPU 151 is started by informing the power-saving controlling portion 144 in the print controlling portion 12 of the interruption only when the information is addressed to own system. Therefore, the start of the CPU 151 can be executed 15 speedy and reduced to the lowest minimum.

[0041]

In addition, the receiving speed of the data from the host computer 20 is decided based on the return time from the power-saving mode to the normal transfer mode and the 20 buffer storing amount, then the data are received based on this decided receiving speed at the time of return, and then the data are stored in the buffer storing portion 145 under the control of the data-storing controlling portion 146. Therefore, the receiving speed can be set on the host 25 computer 20 side not to generate the host time-out error.

As a result, after the cancel of the power-saving mode, the generation of the time-out error in the host computer can be prevented without the intervention of the CPU 151, and thus the flexible communication control can be carried out.

5 [0042]

[Second Embodiment]

FIG.4 is a block diagram showing an outline of a configuration of a printing system according to a second embodiment of the present invention. In FIG.4, a printing system 50 according to the present embodiment is constructed such that such printing system comprises a printing portion 51, a print controlling portion 52, a main power supply portion 53, and a power supply controlling portion 54, and is connected to a host computer 60 as the upper system, for example, via a parallel bus 70 to transmit/receive the parallel data to/from the host computer 60.

[0043]

The print controlling portion 52 is constructed such that such print controlling portion has a communication I/F 55 for executing the communication with the host computer 60 via a parallel bus 70, and a controlling portion 56 for controlling the overall present system, and the power source is directly supplied from the main power supply portion 53 to the communication I/F 55, and also the power source is selectively supplied to the printing portion 51 and the

controlling portion 56 via a power supply switch 57.

[0044]

In this print controlling portion 52, the communication I/F 55 is constructed to have a 1284 interface 551, a REQ controlling portion 552, a DMAC 553, and a timer 554 and to respond to various communication standards.

5 The 1284 interface 551 consists of a 1284 controlling portion 555 and a FIFO (first-in first-out) controlling portion 556, and executes the communication control based on IEEE (The 10 Institute of Electrical and Electronics Engineers, Inc.) 1284 standard that can achieve the illustrated high-speed parallel transfer, for example.

[0045]

The communication interface is not limited to the 1284 interface 551, and the USB (Universal Serial Bus) interface, the LAN (Local Area Network) interface (100BT interface), etc. may be employed. Also, the system in which the interface is connected simultaneously to the upper system, i.e., the host computer 60, may be employed.

20 [0046]

In the situation that the HALT (halt) state signal output from the CPU 561 in the controlling portion 56 indicates the normal transfer mode, when the data transfer requesting signal is output from the 1284 interface 551, 25 the REQ controlling portion 552 outputs the data transfer

requesting signal to the DMAC 553. The DMAC 553 executes the DMA transfer in response to this data transfer requesting signal. The timer 554 monitors the DMA transfer requesting signal output from the DMAC 553, then counts a negate period 5 of the DMA transfer request, i.e., a period during when the DMA transfer requesting signal is not output, and then outputs a time-out interrupt signal to the CPU 561 when this count value comes up to a predetermined value that is decided previously.

10 [0047]

The controlling portion 56 is constructed such that such controlling portion has the CPU 561, a RAM 562, a ROM 563, and a bridge image processing portion 564, and the bridge image processing portion 564 is connected mutually 15 to the printing portion 51, the power supply controlling portion 54, and the communication I/F 55 via an internal bus 58. The program executed in the CPU 561, etc. are stored in the ROM 563. The clock is supplied to the power supply controlling portion 54 from an oscillator (not shown), and 20 also the receiving interrupt signal is input into the power supply controlling portion 54 from the communication I/F 55. The power supply controlling portion 54 supplies the clock supplied from the oscillator as it is to the CPU 561 and the bridge image processing portion 564 in the 25 controlling portion 56 or supplies the masked clock to them.

[0048]

In the printing system 50 having the above configuration according to the second embodiment, the transmission data from the host computer 60 as the upper system is input into the DMAC 553 via the 1284 interface 551. When the DMAC 553 receives the reception data, it transmits the DMA transfer requesting signal to the bridge image processing portion 564 via the internal bus 58 and also outputs the input data onto the internal bus 58. The data being output onto the internal bus 58 is transferred to the RAM 562 as a main memory via the bridge image processing portion 564. The data being DMA-transferred to the RAM 562 is subjected to the image process by the CPU 561, and then output to the printing portion 51 via the bridge image processing portion 564.

[0049]

Then, an operation in shifting the mode from the power-saving mode to the normal transfer mode will be explained in compliance with a flowchart in FIG.5 hereunder.

20 [0050]

First, when the power supply of the printing system 50 is turned ON, the power supply controlling portion 54 supplies the power source to the controlling portion 56 and enters into the normal transfer mode (step S201). In this 25 normal transfer mode, when the data reception is started

via the 1284 interface 551, the DMA transfer is carried out by the above operation. When the data reception is completed but the subsequent data is not received, the timer 554 is started. If the subsequent DMA transfer requesting 5 signal is not asserted within a predetermined time, i.e., if the DMA transfer is not carried out between the DMAC 553 and the RAM 562 for the predetermined time, a time-out interrupt signal is output from the timer 554 to the CPU 561 (step S202).

10 [0051]

When the CPU 561 receives the time-out interrupt signal, such CPU 561 sets the communication control information used in the shift from the power-saving mode to the normal transfer mode (referred to as a "receiving mode/parameter" 15 hereinafter) in the 1284 controlling portion 555 in the 1284 interface 551, and also informs the REQ controlling portion 552 of the effect that the controlling portion 56 is shifted into the power-saving mode and thus the DMA transfer cannot be executed, and negates the data requesting signal to the 20 DMAC 553 (step S203).

[0052]

Then, the CPU 561 outputs the power supply OFF informing signal to the power supply controlling portion 54 via the bridge image processing portion 564 such that 25 the power source supply to the controlling portion 56 can

be stopped. Then, the power supply controlling portion 54 turns OFF (opens) the power supply switch 57 in response to the power supply OFF informing signal. Accordingly, the power supply to the controlling portion 56 is stopped and 5 the system is shifted into the power-saving mode (step S204). At this time, the power supply is still supplied continuously to the communication I/F 55.

[0053]

The shift from the power-saving mode to the normal 10 transfer mode is carried out according to following procedures. In other words, when the 1284 controlling portion 555 in the 1284 interface 551 received the data after this data is transmitted from the host computer 60, such 15 1284 controlling portion 555 detects a change in the input control signal (a leading edge of the strobe signal) (step S205) and asserts the reception interrupt signal to the power supply controlling portion 54 (step S206). At this time, the power supply controlling portion 54 receives this reception interrupt signal to turn ON the power supply switch 20 57. Accordingly, the power source supply to the controlling portion 56 is started again, and the CPU 561 starts the boot process (building-up process).

[0054]

The CPU 561 outputs a return informing signal to the 25 REQ controlling portion 552 when the boot process is

completed (step S207) and sets the normal transfer mode in the 1284 controlling portion 555 in the 1284 interface 551. Thus, the DMA transfer is restarted. More particularly, the REQ controlling portion 552 receives the return informing 5 signal from the CPU 561 and asserts the data requesting signal to the DMAC 553. In response to this, the DMAC 553 adjusts the DMA transfer requests from other modules and requests the acquirement of the internal bus 58 by outputting the DMA transfer requesting signal to the CPU 561 (step 10 S208).

[0055]

Then, when the DMAC 553 can acquire the internal bus 58, it outputs the ACK signal to the FIFO controlling portion 556 in the 1284 interface 551 and also outputs the DMA 15 transfer requesting signal to the timer 554 (step S209). Thus, the timer 554 is reset. Also, the FIFO controlling portion 556 receives the ACK signal and outputs the stored data to the DMAC 553. Accordingly, the DMA transfer is carried out between the DMAC 553 and the RAM 562. That is, 20 the mode is shifted into the normal transfer mode (step S210).

[0056]

In a series of above procedures, the case of the power-saving mode where the power supply controlling 25 portion 54 stops the power source supply to the controlling

portion 56 is described as an example. In the case of the power-saving mode (sleep mode) where the power supply controlling portion 54 also stops the clock supply to the controlling portion 56, the process can be carried out in 5 compliance with the similar procedures.

[0057]

In this case, in setting the receiving mode/parameter in the above power-saving mode, the lowest receiving data buffer capacity is reserved as the system based on the 10 previously decided returning time from the power-saving mode to the normal transfer mode in the present printing system 50 and the time-out setting time of the host system. If the storing buffers (memories) are present in the FIFO controlling portion 556 and the 1284 controlling portion 15 555, the receiving data buffer capacity used herein is given as a sum of both buffer capacities.

[0058]

The data reception to meet the return time can be carried out without fail by using the reception parameter 20 (receiving speed) set herein. More particularly, a busy assert period shown in FIG.6 is adjusted in the parallel interface based on 1284. The assert time can be implemented relatively easily if it is set constant by the register, as described above.

25 [0059]

In addition, as shown in FIG.7, the assert time can be decided dynamically from a residual amount of the received-data buffer capacity. Accordingly, in the transition period from the power saving mode to the normal transfer mode, the busy signal is asserted per one data reception for a time set by the 1284 controlling portion 555. Therefore, if the reception (handshake) is continued at the data receiving speed that is below the time-out period of the host system until a time required to return from the power saving mode has lapsed, the state that the 10 received-data buffer capacity is filled to assert busy can be avoided.

[0060]

Also, since the shift from the power saving mode to the normal transfer mode, i.e., the decision of the cancel of the power saving mode is started by detecting the change of the input control signal in the parallel interface (leading edge of the strobe signal), the power saving mode can be canceled to respond the inquiry immediately when the inquiry, i.e., the transmission request, is issued from the upper system (host computer 60) to the present printing system 50 in the power saving mode. As shown in FIG.8, this is because the strobe signal is changed in a negotiation phase based on IEEE1284 standard and thus the interrupt 20 signal can be asserted by the above edge detecting means.

[0061]

As described above, in the printing system 50 connected to the host computer 60 as the upper system via the parallel bus, the data can be received based on the previously-set 5 communication control information without the CPU 561 immediately after the shift from the power saving mode to the normal transfer mode. Therefore, it is possible to receive the data within the returning time from the power saving mode not to generate the time-out error in the upper 10 system side. As a result, the mode can be returned to the normal transfer mode not to lower extremely the data transfer efficiency. That is, the FPOT that is most suitable for the present printing system 50 can obtained.

[0062]

15 In addition, since the decision of the cancel of the power saving mode is made by detecting the change of the input control signal line in the parallel interface, the mode can be shifted into the normal transfer mode by immediately canceling the power saving mode even when not 20 only the data is to be received but also the inquiry, i.e., the transmission request, is issued from the upper system (host computer 60) to the present printing system 50 in the power saving mode.

[0063]

25 [Advantages of the Invention]

As described above, according to the present invention, in the shift from the power-saving mode to the normal mode, the generation of time-out error on the upper system side can be avoided and also the FPOT can be optimized.

5

[Brief Description of the Drawings]

[FIG.1] A block diagram showing an outline of a configuration of a printing system according to a first embodiment of the present invention.

10 [FIG.2] A flowchart for explaining an operation of the printing system according to the first embodiment.

[FIG.3] Views showing an example of a relationship between a communication time between a host computer and a print controlling portion and a buffer storing amount every 15 mode respectively.

[FIG.4] A block diagram showing an outline of a configuration of a printing system according to a second embodiment of the present invention.

20 [FIG.5] A flowchart for explaining an operation of the printing system according to the second embodiment.

[FIG.6] A timing chart showing a basic handshake of a parallel interface.

25 [FIG.7] A view showing an example of a relationship between a received-data buffer empty capacity and a busy assert period.

[FIG.8] A transition timing chart from a compatible mode to a negotiation phase of a parallel interface based on IEEE1284.

[Explanation of the Symbols]

5 10, 50...printing system, 11, 51...printing portion,
12, 52...print controlling portion, 13, 53...main power
supply portion, 14, 55...communication I/F (interface), 15,
56...controlling portion, 16, 57...power supply switch, 20,
60...host computer (upper system), 30...serial bus, 70...
10 parallel bus.

[Document Name] Abstract

[Abstract]

[Subject] If a time required for a building-up process of CPU is long in the case that, in returning from a power saving

5 mode, first a CPU executes the building-up process and then an operation is shifted to a receiving operation, a time exceeds a host time-out time to cause a transmission error.

[Solving Means] In a printing system 10 connected to a host computer 20 as an upper system via a serial bus,

10 communication control information used in a shift from a power saving mode to a normal transfer mode are previously in a response controlling portion 147 before a CPU 151 in a printing controlling portion 12 is shifted into the power saving mode, and then the response controlling portion 147
15 can receive the data based on the set communication control information without intervention of a CPU 151 in the cancel of the power saving mode.

[Elected Figure] FIG.1

FIG.1:

- (1) printing system 10
- (2) printing portion 11
- (3) print controlling portion 12
- 5 (4) main power supply portion 13
- (5) host computer 20
- (6) serial bus 30
- (7) serial/parallel I/F 141
- (8) command/data analyzing portion 142
- 10 (9) data payload controlling portion 143
- (10) power-saving controlling portion 144
- (11) buffer storing portion 145
- (12) data-storing controlling portion 146
- (13) response controlling portion 147
- 15 (14) power supply controlling portion 155
- (15) setting information
- (16) power-saving mode inform/cancel
- (17) interrupt information

FIG.2:

- 20 (1) start
- (2) normal transfer mode (S101)
- (3) the power-saving mode shift authorization requested ?
(S102)
- (4) set communication control information (S103)
- 25 (5) Setting of the communication control information

completed ? (S104)

(6) issue the power-saving mode shift authorizing response signal (S105)

(7) The data addressed to own system detected ? (S106)

5 (8) inform interrupt/inform power-saving mode cancel (S107)

(9) operate by the communication control information (S108)

(10) transfer authorization OK ? (S109)

(11) start DMA transfer (S110)

(12) shift to the normal transfer mode (S111)

10 (13) end

FIG.3:

(1) mode A

(2) time

(3) buffer storing amount

15 (4) buffer residual capacity

(5) mode B

(6) mode C

(7) set value Co

(8) mode D

20 FIG.4:

(1) printing system 50

(2) printing portion 51

(3) print controlling portion 52

(4) main power supply portion 53

25 (5) power supply controlling portion 54

- (6) communication I/F 55
- (7) controlling portion 56
- (8) host computer 60
- (9) parallel bus 70

5 (10) REQ controlling portion 552

- (11) timer 554
- (12) 1284 controlling portion 555
- (13) FIFO controlling portion 556
- (14) bridge image processing portion 564

10 FIG.5:

- (1) start
- (2) normal transfer mode (S201)
- (3) Time-out interrupt signal output ? (S202)
- (4) set a receiving mode/parameter,

15 negate a data requesting signal (S203)

- (5) power-saving mode (S204)
- (6) A strobe edge of the input control signal detected ?
(S205)
- (7) assert a reception interrupt signal (S206)

20 (8) output a return informing signal (S207)

- (9) acquire an internal bus (S208)
- (10) output an ACK signal (S209)
- (11) shift to the normal transfer mode (S210)
- (12) end

25 FIG.6:

- (1) strobe input signal
- (2) busy output signal
- (3) busy assert period

FIG.7:

- 5 (1) empty capacity of the received-data buffer
- (2) busy assert period
- (3) time-out period